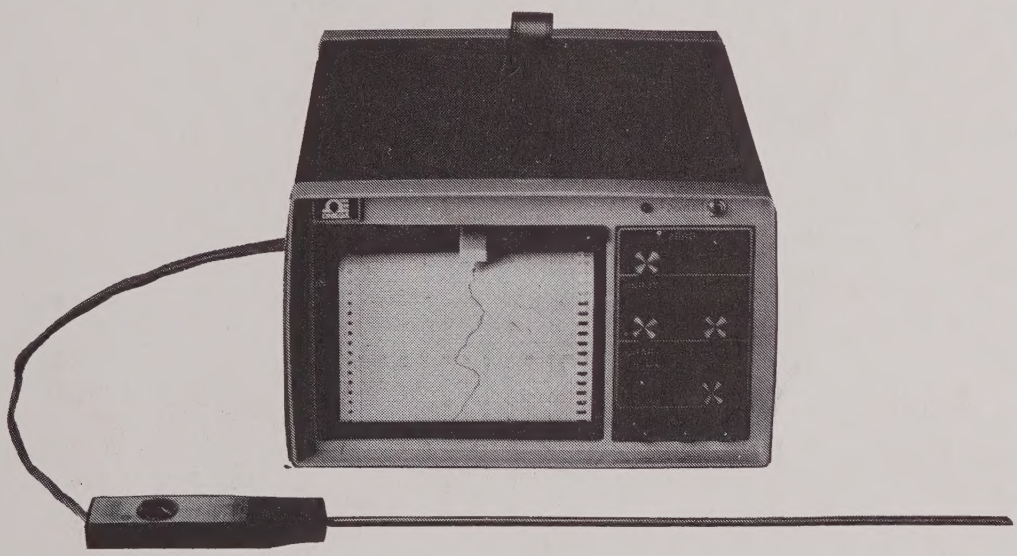
MODEL 141 and MODEL 142

Portable Strip Chart Recorder



Operator's Manual

OMEGA ENGINEERING, INC.
An OMEGA Group Company

WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of 13 months from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the normal one (1) year product warranty to cover handling and shipping time. This ensures that our customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. Our Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive current, heat, moisture, vibration, or misuse. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

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Direct all warranty and repair requests/inquiries to OMEGA Customer Service Department, telephone number (203) 359-1660. Before returning any instrument, please contact the OMEGA Customer Service Department to obtain an authorized return (AR) number. The designated AR number should then be marked on the outside of the return package.

To avoid processing delays, also please be sure to include:

1. Returnee's name, address, and phone number.
2. Model and Serial numbers.
3. Repair instructions.

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Printed in U.S.A. M92/056

CONTROLLED DOCUMENT
PORTABLE STRIP CHART RECOR
CONTROL # E-5472
DATE: 10/07/94
IML 21 QA

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SECTION 1 INTRODUCTION

1.1 GENERAL DESCRIPTION

The OMEGA® Model 141 and 142 Portable Chart Recorders are multi-range potentiometric, null balance servo recorders which will provide an accurate, permanent, graphic record of the input signal. These recorders feature a unique servo drive system that practically eliminates deadband, plus an electronic servo "shutdown" for off scale protection. The Model 141 and 142 Recorders may be used with thermocouples (1 mV or 10 mV range - cold junction compensated) or digital instruments with analog output in a variety of applications where the use of a precision instrument is important.

Model 142 is identical to its counterpart, except that its operation is powered by an internal, rechargeable battery pack. This recorder can be utilized for field operation where normal ac power is not available.

1.2 FEATURES

The Model 141 and 142 Recorders provide the following features:

- Lightweight and portable
- Battery powered (Model 142 only)
- Five selectable input spans from 1 mV to 10 V
- Ten selectable chart speeds
- 100 mm chart width
- 100% zero suppression
- 100% full-scale zero
- Uses disposable fiber-tipped pens

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the Packing List and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department at (203) 359-1660.

Upon receipt of shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

2.2 CHECKING THE FUSE

Verify that the proper fuse is correctly installed on the back panel of the recorder. The recorder is shipped with a 0.15 A fuse for operation at 115 V, 60 Hz.

2.3 POWER REQUIREMENTS

The Model 141 Recorder is designed to operate on 115 or 230 V ac, 50, 60, or 400 Hz, single phase. The Model 142 is designed to operate from a self-contained, rechargeable, 12 V dc, sealed lead-acid battery. The battery will be charged when operating from 115 or 230 V ac, 50, 60, or 400 Hz, single phase.

NOTE

Be sure to set the conversion switch, located on the back panel, for the correct line voltage.

2.4 GROUNDING REQUIREMENTS

For best performance, the green (or green and yellow) ground wire in the power cord and the signal source should share a common earth ground. The green (green and yellow) wire in the power cord, is connected to the recorder ground (chassis), but not to the signal input. If the signal input does not have a third wire in its power cord, or if the instrument is not grounded, connect a wire between the recorder ground (green terminal) and the chassis of the signal source.

In the case of large common-mode signals, connect the recorder ground (green terminal) to the source of the common-mode signal, or to the negative recorder input (black terminal).

2.5 REAR PANEL TERMINAL STRIP

There are two terminal strips on the rear of the recorder, see Figure 2-1.

The top strip is wired for input signals (left to right)

1. Terminal 1--positive
2. Terminal 2--negative
3. Terminal 3--ground
4. Terminal 4--not used

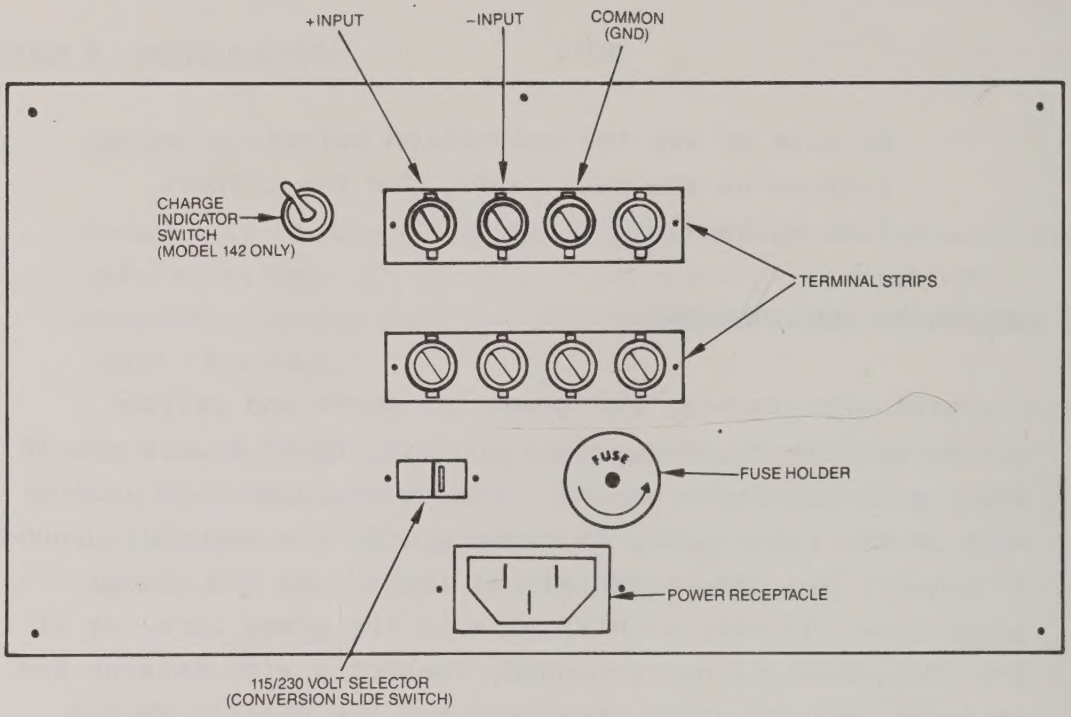


Figure 2-1. Model 141 and 142 Rear Panel View

2.6 INPUT SIGNAL CONNECTIONS

This instrument requires dc voltage input. Signal sources with current outputs will require a shunt resistor to be placed across the + (red) and - (black) inputs. Ohm's law may be used to compute the proper value for a given input range. The formula is :

$$R = \frac{E}{I}$$

Where E is the recorder span range selected in volts,
I is the maximum current signal to be recorded in amps,
R is the resistance of the shunt resistor in ohms.

Electrical connections are made as follows:

Signal source positive to recorder red (+) terminal.
Signal source negative to recorder black (-) terminal.

Left-hand chart zero is standard on the recorder. Positive signals drive the pen to the right. If it is desired to drive the pen in the opposite direction, reverse the input leads and use the ZERO control to position the pen at the opposite side of the chart. Negative signals will now drive the pen to the left.

NOTE

This unit is calibrated for left-hand zero. Reversal of the input leads might cause a ± 3% full-scale error.

2.7 CHART PAPER INSTALLATION

1. Pull the release lever, on front left side of recorder (See Figure 2-2) forward to pull out chart drawer for loading.

2. Insert the metal tube inside a new roll of chart paper. The metal insert provides the proper weight and tension to feed the roll as it is consumed.

3. With the round sprocket holes on the left side, insert the new roll of chart paper into the trough (directly behind the paper feed sprockets).

4. Remove the tape and roll out a strip of paper about 12 inches long.

5. Push the end of the chart paper through slot in bottom front of the chart drawer.

6. Push the spare core onto the take-up post. Push the chart paper under the spare core. Tape the end of paper to core.

7. Turn the core to take up any slack in the chart.

8. Close the drawer by pushing on the center of the chart. Do not push the release lever.

9. Chart is now loaded for operation.

2.8 PEN INSTALLATION

To install the recorder pen, proceed in the following manner:

1. Remove the pen cap and store it in a safe location.

NOTE

Pens can be left uncapped for a long period of time. However, the life of the pen will be substantially extended if the pen is capped when not in use.

2. Lift the marker scale (on the front of the recorder) by pushing the center of the scale up. The scale should pivot 90° and raise the pen carriage.

3. Insert the pen into the carriage until it stops.

4. Push the lever down on the right side of the scale plate to position the pen on the chart, and return the scale to its normal position.

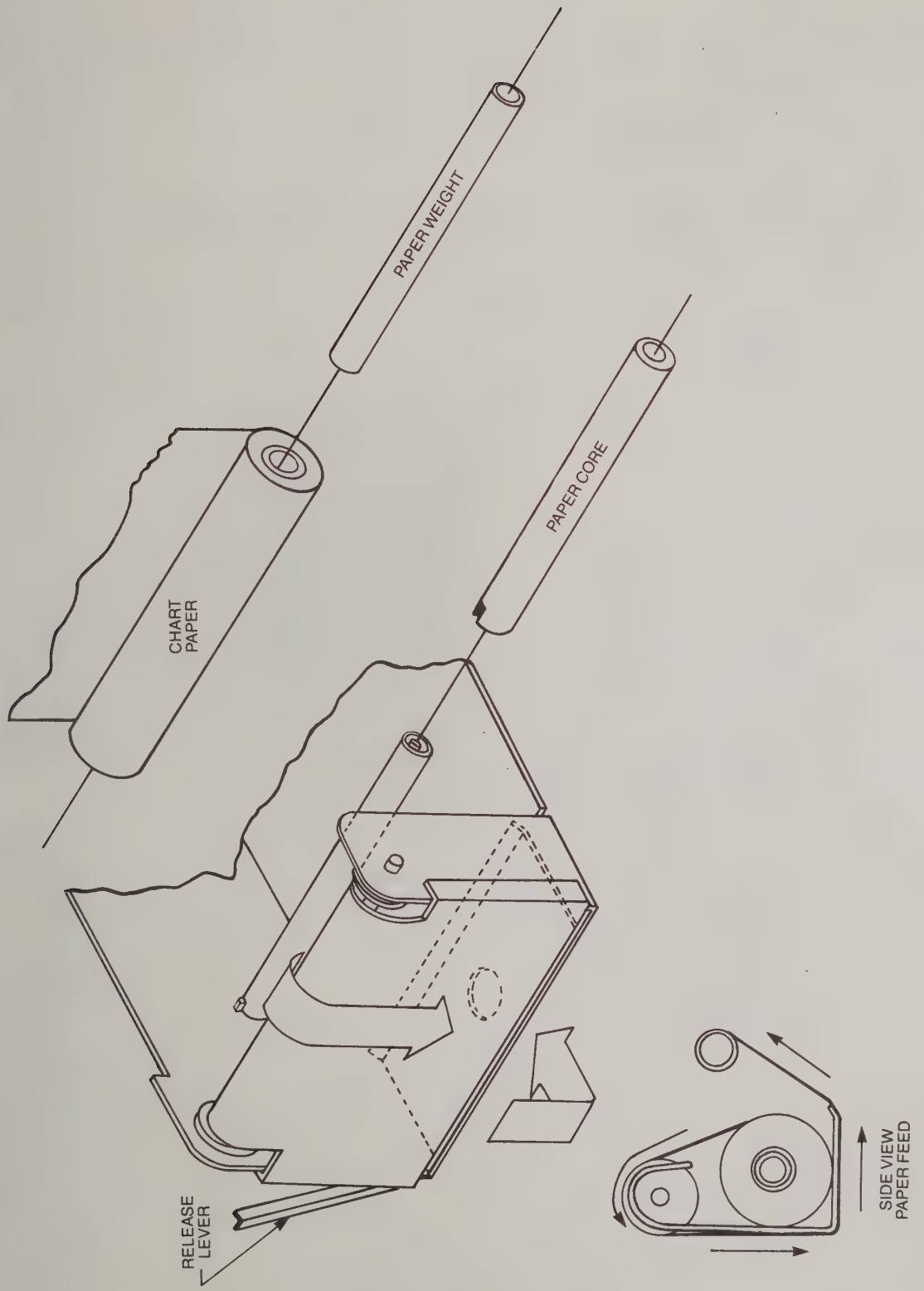


Figure 2-2. Model 141 and 142 Chart Paper Installation

SECTION 3 OPERATION

3.1 CONTROLS AND INDICATORS

Figure 3-1 and Table 3-1 lists and describes the operating controls found on the Model 141 and 142 Portable Recorders.

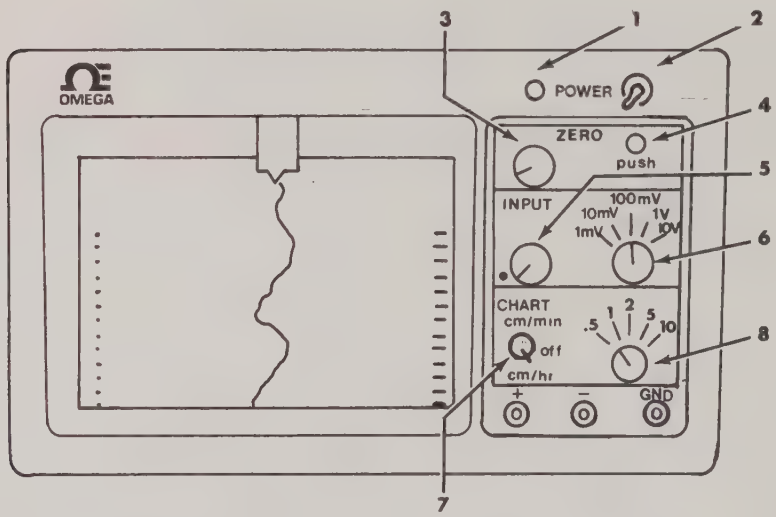


Figure 3-1. Controls and Indicators

TABLE 3-1

RECORDER CONTROLS AND INDICATOR

ITEM NO.	CONTROL OR INDICATOR	FUNCTION
1	POWER indicator	An illuminated POWER indicator for the Model 142 lets the operator know that the battery is being charged.

TABLE 3-1 (Continued)

RECORDER CONTROLS AND INDICATOR

ITEM NO.	CONTROL OR INDICATOR	FUNCTION
1	POWER indicator (continued)	When the indicator is the Model 141 is lit, it signifies that power is being applied to the recorder.
2	POWER toggle switch	This two position switch is used to turn the recorder ON and OFF.
3	ZERO rotary control	This control is used to set the recorder to zero on the recorder chart. It is used in conjunction with the ZERO push-button control.
4	ZERO push-button switch	In order to set zero on the chart paper, this control must be pressed and held. It is used in conjunction with the ZERO control.
5	ATTEN/Calibration Control	In position ATTEN, the position of the pen can be moved to the desired location on the chart paper.

TABLE 3-1 (Continued)

RECORDER CONTROLS AND INDICATOR

ITEM NO.	CONTROL OR INDICATOR	FUNCTION
5	ATTEN/Calibration Control (continued)	When set to position calibrate (white dot on the control panel), the recorder pen can be set to full-scale on the chart paper.
6	SPAN SELECTOR control	This five position rotary switch can be used to select one of the following span ranges: 1 mV, 10 mV, 100 mV, 1 V, and 10 V.
7	CM/MIN--OFF--CM/HR control	A three position rotary switch that can be used to select the recorder drive rate. In position OFF, the recorder chart drive is turned OFF. When set to position CM/MIN or CM/HR, the chart drive moves the chart paper at the rate--per minute or per hour--selected by the use of the Chart Speed control (item 8, this Table).

TABLE 3-1 (Continued)
RECORDER CONTROLS AND INDICATORS

ITEM NO.	CONTROL OR INDICATOR	FUNCTION
8	Chart Speed control	Specifies the rate at which the chart drive will move the chart paper. Available settings are .5, 1, 2, 5, and 10. This control is used together with the CM/MIN--OFF--CM/HR control.

3.2 OPERATING PROCEDURE (Model 141 and 142)

1. Plug the recorder into the wall outlet (Model 141 only).

2. Set the POWER switch to position ON; the POWER indicator will light (Model 141 only).

3. Set the CM/MIN--OFF--CM/HR switch to position OFF.

4. Set the SPAN SELECTOR control to the appropriate range.

5. Set the ATTEN/Calibration control to position Calibrate (white dot on control panel).

6. Push and hold the ZERO push-button switch and simultaneously adjust the ZERO control to position the recorder pen at zero on the chart paper. Release the push-button switch.

7. Apply an input signal (of a known value) to the recorder.

8. Set the chart paper speed control to the appropriate rate and set the CM/MIN--OFF--CM/HR to position CM/MIN or CM/HR, as appropriate.

9. As the recorder begins to trace, make sure the holes on the chart paper are properly aligned on the chart drive sprocket teeth.

OPERATING NOTES

1. when switching from one sensitivity range to another, it may be necessary to rezero the pen. To do so, push the ZERO push-button switch and readjust the ZERO control. (The ZERO control has no stops at the end of its mechanical travel.) One hundred percent zero suppression is standard on all recorders and allows zero setting from -100% to +100%.

2. The pen may drift when no signal is present at the input.

3. If the pen is physically stalled on the chart for a few seconds, the servo system will shut down to protect the motor (and the battery against drainage of power, Model 142). The best way to reset the system is to turn the recorder OFF for about five seconds, and then ON. The pen should proceed to record normally.

4. If the shutdown resulted from an overrange, the recorder will operate normally as soon as the input signal decreases to a level within the selected span range.

3.3 POWER INDICATOR (MODEL 142 ONLY)

The POWER INDICATOR shows when the battery is charging. The charger draws a current load of approximately 160 mA.

When the voltage reaches a level of 14.8 V, the charger automatically turns OFF. Conversely, at a voltage level of 13.7 V, the charger becomes actuated and the indicator lights. During normal operation, the indicator should be OFF more often than ON.

NOTE

On Model 141, the indicator lights when power is applied and extinguishes when power is removed.

3.4 BATTERY OPERATION (MODEL 142 ONLY)

Model 142 operates from an internal "sealed" lead-acid battery with an out-gas rating of 60 psi. When the power cord is plugged into an ac line, and the power switch is ON, the battery is charged; therefore, should a power failure occur, the recorder will continue normal operation.

WARNING

DO NOT short the battery contacts.

CAUTION

This instrument will be seriously damaged if operated with ac power when the battery is removed.

3.5 CHARGE INDICATOR (MODEL 142 ONLY)

The charge indicator is a unique feature on the Model 142 recorder. It provides a direct readout of the present state of the battery charge.

The battery has a linear slope ranging between 11 and 12.8 V. These voltages are fed into a voltage divider and then to the servo to derive the battery charge indication.

3.6 BATTERY CHARGE CHECK (MODEL 142 ONLY)

The approximate charge remaining on the battery can be determined in the following manner:

1. Unplug the recorder from the wall outlet.

2. Set the CM/MIN--OFF--CM/HR control to either operating position and allow the recorder to warm up for a few minutes.

3. Press the ZERO push-button switch and while holding it in, use the ZERO control to set the pen to zero on the chart paper. Release the push-button switch.

4. Press down, and hold for a few seconds, the Charge Indicator switch on the rear of the recorder.

5. The position of the pen indicates--in direct percentage--the amount of remaining battery charge.

NOTE

If the pen is positioned at 20% on the chart, the battery is fully charged.

3.7 BATTERY CHARGE (MODEL 142 ONLY)

The length of time a charge will last depends upon the speed at which the chart is run and the recording rate. For example, at a chart speed of 10 cm/min and a recording rate of 1 Hz, the battery will last a minimum of six hours. With a trend line and a cm/hr chart speed, the battery will last approximately eight days. Under nominal operation, the battery will last approximately 80 hours between charges.

There are three levels of battery discharge:

- The normal discharge range is between 13 and 11 V dc. When the battery voltage is checked and indicates 0% on the scale, the battery voltage is 11 V, and should be recharged as soon as possible.

- The medium discharge range is between 11 and 10 V dc. When the battery level falls to 10 V dc, the positive and negative regulated supplies will fail and the unit will exhibit pen oscillations or loss of zero control.
- The severe discharge range is between 9 and 0 V dc. In this range, the recorder will cease to operate.

To recharge a normal, medium or severly discharged battery, refer to the procedure outlined in Section 5.2.

SECTION 4 THEORY OF OPERATION

4.1 GENERAL

The dc input signal to the recorder is first filtered and then amplified by the pre-amplifier to a level which is less susceptible to noise and interference. This conditioned signal is then applied to a differential amplifier which continuously compares it to the feedback signal developed by the servo potentiometer.

The difference between these two signals is a positive or a negative error signal that is amplified and used to drive the servo motor. The servo motor is coupled to the servo potentiometer to drive the pen in a direction that will reduce the error signal to zero. Since the recorder pen is mechanically coupled to the servo motor and the servo potentiometer, its position on the chart represents an accurate, and continuous, permanent graphic record of the input signal.

4.2 DC POWER SUPPLY

AC line voltage is reduced by a stepdown transformer and is converted to dc by solid state rectifiers. A stable dc voltage, generated by a compensated zener diode, is used as a reference voltage for the servo potentiometer.

The Model 142 internal battery receives a dc charge current through the charge circuit.

4.3 PEN DRIVE

A dc servo motor controls the servo potentiometer and the recorder pen by means of belt driven servo drum, which is coupled to the pen carriage. As the drum rotates, the pen is moved across the chart for a distance that is proportionate to the amount of drum rotation.

4.4 CHART DRIVE

An internal oscillator generates pulses which are divided by the integrated circuit logic. The power is turned OFF between step pulses (to the motor) which causes the amount of power that is consumed to be directly proportionate to the chart speed. The Chart Speed control selects the appropriate pulse rate necessary to drive the stepper motor at the desired speed.

SECTION 5 SERVICE INFORMATION

5.1 MAINTENANCE

The Portable Recorders are sturdy and long lasting instruments that require little servicing or maintenance. Nevertheless, the performance of a few maintenance procedures will enhance trouble free operation and help to extend the life of the instrument.

5.1.1 Routine Cleaning

The exterior surface of the recorder should be cleaned periodically by wiping it with a soft damp cloth. Water may be used to remove ink, etc; however, solvents should not be used as they may damage or destroy the finish.

5.1.2 Pen Care

Chart paper and pens have been carefully matched for optimum writing and minimum bleed. Substitutions could cause improper writing. Keep the pen tips covered when not in use to prolong writing life.

NOTE

If the pen is left uncapped for a long period of time and dries out, it may be revitalized by dipping it in water for a few seconds.

5.1.3 Recording Stability

If high recorder accuracy and stability are required, allow the recorder to warm up for approximately 30 minutes before proceeding with routine operation.

5.1.4 Proper Chart Paper Tension

Firm tension on the paper roll and correct alignment of the chart paper holes on the sprocket teeth are required for proper chart paper feed. Make certain that the metal core is securely inserted within the paper supply roll.

5.2 RECHARGING THE BATTERY (MODEL 142 ONLY)

During operation, it may be necessary to recharge the battery under normal discharge conditions as well as under severe discharge conditions.

5.2.1 Normal Discharge Recharge Procedure

Recharge the battery:

1. Plug the recorder into the ac power outlet.

2. Set the SPAN SELECTOR control to position 1 V or 10 V.

3. Set the POWER switch to position ON.

4. Set the CM/MIN--OFF-CM/HR control to position OFF.

5. DO NOT apply an input signal to the recorder. The battery will automatically be charged and the POWER indicator will remain lit until the battery is completely charged.

5.2.2 Medium or Severe Recharge Procedure

Commence the recharge cycle:

1. Plug the recorder into the ac power outlet.
2. Set the POWER switch to position ON.
3. Set the CM/MIN--OFF--CM/HR control to position OFF.
4. Set the SPAN SELECTOR control to position 10 V. (The POWER indicator will light to indicate that the battery is being charged.)
5. Press the ZERO push-button switch and simultaneously set the pen to zero on the chart paper with the ZERO control. (If the pen does not deflect, manually move the pen to zero.)
6. While physically holding the pen at zero on the chart paper (left side), turn the ZERO control ten turns in a clockwise direction. The pen should remain at the same position when the pen is released (under servo motor shutdown condition).

7. Permit the battery to recharge for a minimum of 16 hours (in order to receive a full charge).

CAUTION

No attempt should be made to use the recorder until the recharge cycle has been completed.

NOTE

The battery does not have to be fully charged to use the recorder, but it must be charged above the minimum-level reading on the battery charge indicator.

8. If the battery has been severely discharged (i.e., less than 9 V dc), the recharge cycle is extended to eight days (192 hours). This is necessary because the battery exhibits a high impedance and the battery responds slowly to the recharge current.

5.3 CALIBRATION

OMEGA's Portable Recorders will provide years of reliable and trouble free operation. However, after periods of long term use, the recorder may exhibit signs of loss of sensitivity. At such times, the recorder should be recalibrated by following the procedures outlined in paragraphs 5.3.1 through 5.3.3.

WARNING

Calibration procedures should only be performed by a trained and qualified technician. Since there are potential shock hazards associated with the performance of these procedures, the technician should exercise every precaution to avoid contact with live electrical components.

5.3.1 Current and Voltage Offset Adjustment

This adjustment requires that the recorder signal input be alternately switched between a short circuit and a 50 kilohm resistor. Connect a 50 kilohm resistor across the recorder signal input and use a shorting jumper wire to short the input. The zero control knob should be used to place the pen at approximately half scale for this adjustment.

1. Allow the recorder to warm up to operating temperature (about 30 minutes).
2. Remove the recorder top panel.
3. Set SPAN SELECTOR switch to 1 mV position.
4. Alternately switch the signal input between 50 kilohm and a short circuit while adjusting the current offset potentiometer on the PC board (see Figures 5-1 and 5-2).
5. Short circuit the input terminals and alternately switch between the 1 mV and 10 mV while adjusting the voltage offset potentiometer (Figures 5-1 and 5-2) on the PC board for minimum pen movement.
6. The effects between the voltage and current potentiometers are interactive. Therefore, Steps 4 and 5 must be performed alternately until a minimum amount of pen movement is achieved.

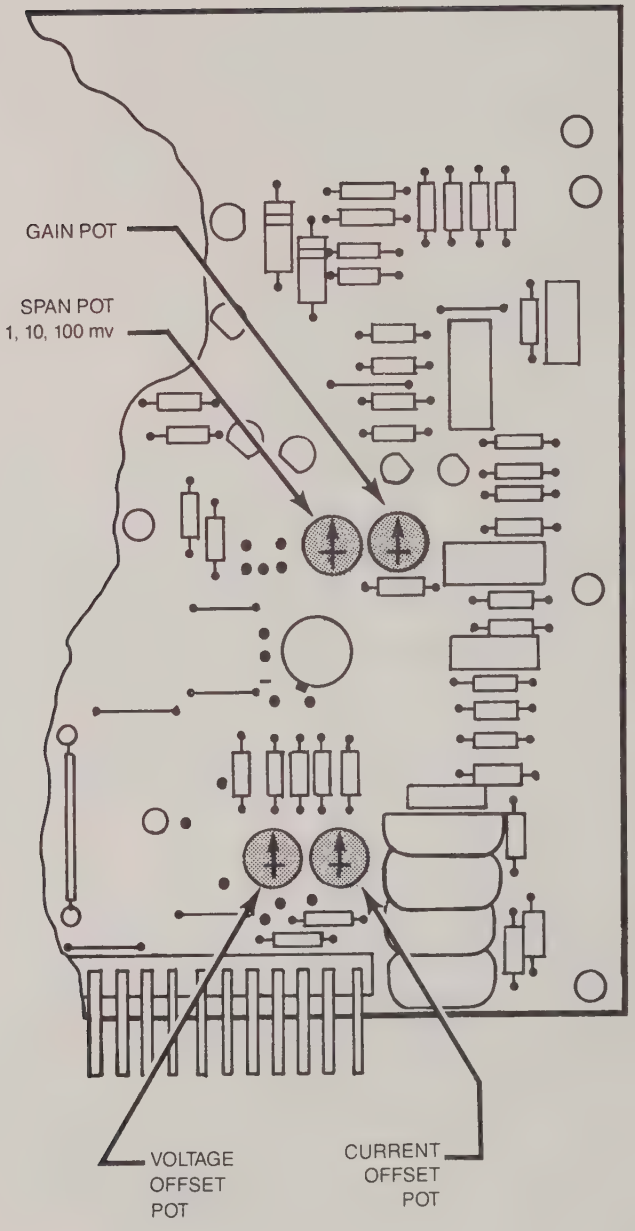


Figure 5-1. OMEGA Model 141 Pulse/Servo PC Board

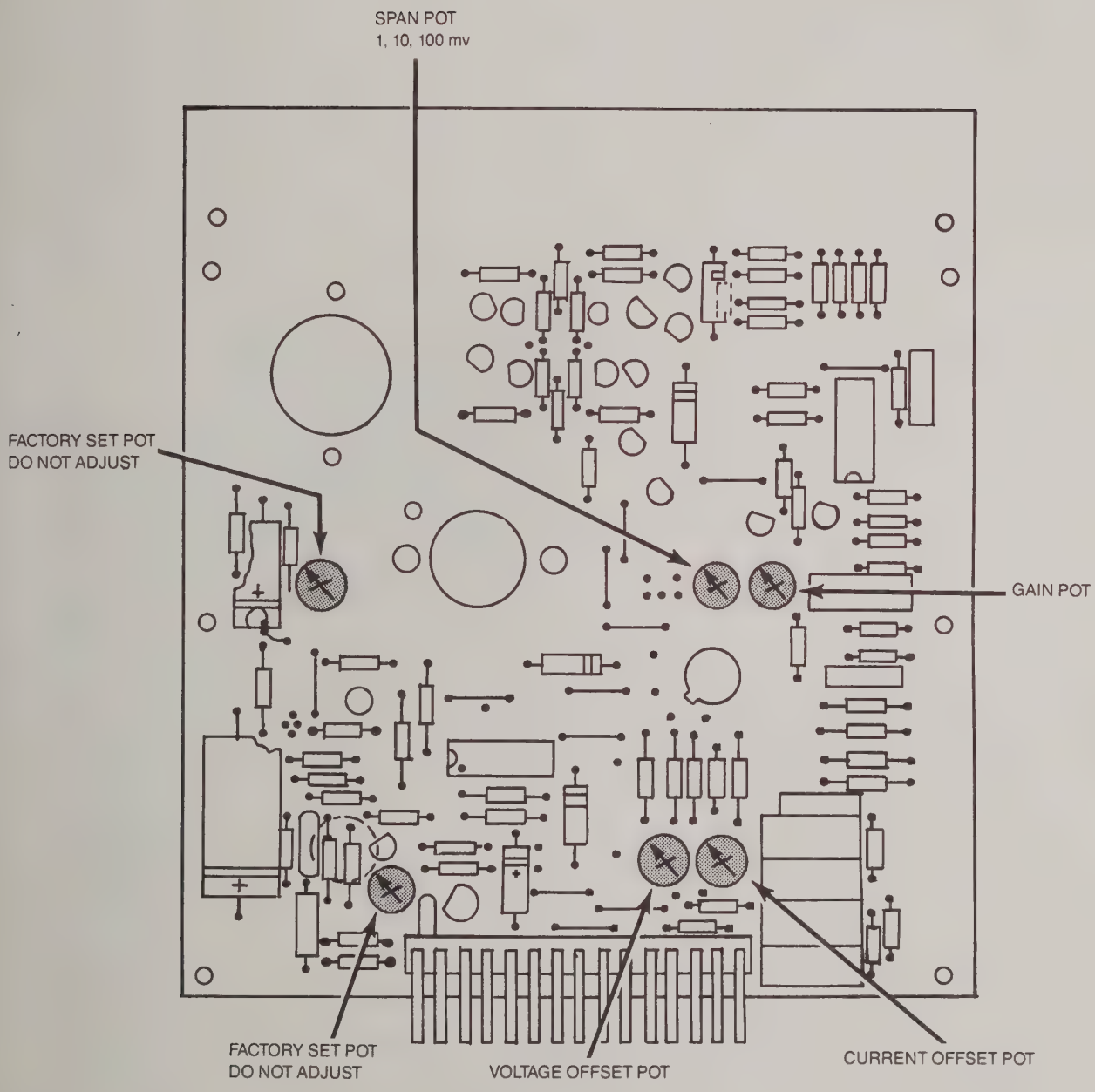


Figure 5-2. OMEGA Model 142 Pulse/Servo PC Board

5.3.2 Gain Adjustment

The GAIN adjustment controls the servo loop gain of the recorder. The gain control (refer to Figures 5-1 and 5-2) can be reached by removing the recorder top panel. If the recorder gain is set too high, the pen will buzz. When it is set too low, the pen will be sluggish and overshoot.

1. Short (+) and (-) inputs (red and black connectors on the front of the recorder), and set zero to center scale by rotating the ZERO control.

2. Adjust the GAIN control clockwise until the pen buzzes; back the control off counterclockwise 5° or 10°.

3. Recheck the adjustment by moving the pen over the full scale by the use of the ZERO control. If the pen buzzes at any point, turn the GAIN control counterclockwise until the buzzing stops.

NOTE

The GAIN control has little, if any, affect on the deadband of this recorder.

5.3.3 Span Calibration

The SPAN adjustment control (see Figures 5-1 and 5-2) can be reached by removing the recorder top panel. This control lets the technician adjust the recorder until the maximum input signal moves the pen to the full width of the chart paper.

1. Allow the recorder to warm up to operating temperature (about 30 minutes).
2. Set the recorder to 100 mV position and the signal source to zero volts.
3. Carefully set zero by rotating the ZERO control.
4. Apply a 100 mV signal (0.1% accuracy) to the recorder input.
5. Adjust the potentiometer located on the PC board until the pen is at 100% on the chart paper. Check 1 mV and 10 mV ranges for ± 0.25% full-scale deflection with appropriate inputs.
6. Set the recorder range switch to position 1 V and zero the pen again, if necessary.
7. Apply a 1 V (0.1% accuracy) signal to the input and adjust the potentiometer located on the two lug terminal strip (near the range switch) for 100% full scale deflection.
8. Check the 10 V range for ± 0.25% full-scale deflection.

5.4 TROUBLESHOOTING

The troubleshooting information, along with appropriate schematics and parts lists, are included to serve as a guide to enable equipment repair. The schematics and parts lists may vary slightly from actual production units and are to be used as a guide only. Likewise, the troubleshooting section is a guide only and cannot cover all possible contingencies that may occur.

TABLE 5-1

TROUBLESHOOTING CHART (MODEL 141 AND 142)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
1. Recorder is inactive	Blown fuse	Replace the fuse
	Disconnected signal input leads	Check the input connections
	Pulse servo amplifier PC board is loose in connector.	Secure the PC board.
	Defective pulse servo amplifier PC board	Replace the pulse servo amplifier PC board.
	Defective servo motor	Replace the servo motor.
	Disconnected battery (Model 142 only)	Secure the battery connections.
	Discharged battery (Model 142 only)	Recharge the battery.
	Battery is discharged and will not hold a charge. (Model 142 only)	Replace the battery.

TABLE 5-1 (continued)

TROUBLESHOOTING CHART (MODEL 141 AND 142)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
2. Excessive Deadband	Excessive common-mode signal	Connect the ground terminal to source of the common-mode signal.
	Recorder ground is not connected to the signal source ground	Provide a common ground for the third wire (green or green & yellow) in the power cords.
3. Noise on pen trace	Noisy input signal from the signal source	Check the signal source.
	Gain is set too high	Adjust the GAIN potentiometer.
	Disconnected recorder ground	Provide a common ground for the third wire (green or green & yellow) in the power cord.
4. Pen trace has isolated steps	Dirty pen carriage slide rod	Clean pen carriage slide rod.
	Defective servo motor	Replace the servo motor.

TABLE 5-1 (continued)

TROUBLESHOOTING CHART (MODEL 141 AND 142)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
5. Pens will stop moving, but will catch up if physically pushed	Defective brush contacts in servo motor	Replace the servo motor.
6. Pen writes poorly	Depleted ink supply	Replace the pen.
	Dried out pen tip	Revitalize the pen by dipping it in water for a few seconds.
7. Inoperative chart drive	Loose or defective power connections	Secure or repair the power connections.
	Defective chart drive motor	Replace the chart drive motor.
	Defective stepper chart drive circuit	a. Check the connections to the circuit board. b. Check the dc voltages on the circuit board. c. Replace the stepper chart drive circuit board.

TABLE 5-1 (continued)

TROUBLESHOOTING CHART (MODEL 141 AND 142)

SYMPTOM	PROBABLE CAUSE	CORRECTIVE ACTION
7. (continued)	Drive belt is too loose or is too tight	Adjust belt accordingly
8. No chart drive in a particular chart speed	Loose or defective connections at the chart speed selector and/or at the circuit board connector	Secure or repair connections.
	Defective component on the circuit board	Replace the defective component or replace the stepper chart drive circuit board.

SECTION 6 SPECIFICATIONS FOR MODEL 141 AND 142

CHART WIDTH:	100 mm (calibrated 0-100 divisions); 120 mm overall
WRITING METHOD:	Disposable fiber-tipped pen
CHART SPEEDS:	10 speed metric; settings at 0.5, 1, 2, 5, 10 cm/min or cm/hr.
PEN RESPONSE:	Less than 0.5 seconds, full-scale
POWER:	Model 141: 115 or 230 V ac ± 10%, 50, 60, or 400 Hz, single phase Model 142: 12 V dc internal sealed lead-acid battery (charged from built-in charger)
WATTAGE:	1 Hz @ 10 cm/min. = 5 W; trend line @ cm/hr = 0.15 W
SPAN:	1 mV, 10 mV, 100 mV, 1 V, and 10 V +10:1 Variable attenuator (full-scale)
FUSE:	3AG, SLO-BLO, 0.15 A
INPUT:	Floating; ±100 V, single ended
INPUT IMPEDANCE:	2.5 Megohm fixed, all ranges
ACCURACY	
DEADBAND:	±0.1%

SPECIFICATIONS (continued)

LINEARITY:	±0.5%
REPEATABILITY:	±0.1%
DAMPING:	Critically damped on all ranges (no adjustments are required)
ZERO ADJUST:	Continuously from -100% to +100% (full-scale +100% supression on each range). Left-hand zero is standard
DIMENSIONS:	H: 6.25" (159 mm) x W: 8.75" (222 mm) x D: 11.5" (292 mm)
WEIGHT:	Model 141: 9 1/2 lbs; (4.32 kg) Model 142: 11 lbs; (5 kg)

6.1 ACCESSORIES

DESCRIPTION	PART NUMBER
CHART PAPER, 100-mm	0100-0011
CHART PAPER, Z-fold	0100-0028
RECORDER PEN, Short nib, blue	0100-0105
RECORDER PEN, Short nib, red	0100-0106
RECORDER PEN, Short nib, black	0100-0107
RECORDER PEN, Short nib, green	0100-0108
DUST COVER, Clear	0100-0203

6.2 PARTS LIST

Fuse (Slo Blo) 0.15A	5120-0007
Power Cord (Standard Model	6040-0005
Power Cord (International Model)	6040-0006
Potentiometer (Servo, Rebalance Pot)	4750-0022
Motor (Servo)	3510-0007
Motor (Stepper, Chart)	3525-0013
Switch, Toggle (Dpdt) (power on/off)	5110-0001
Switch, Rotary five position (chart drive speed control)	5130-0003
Pen Carriage Spring	9001-0385
Pen Carriage	9001-0383
LED (Red)	4802-0007
Paper Core	0115-0005
Paper Weight	9001-0404

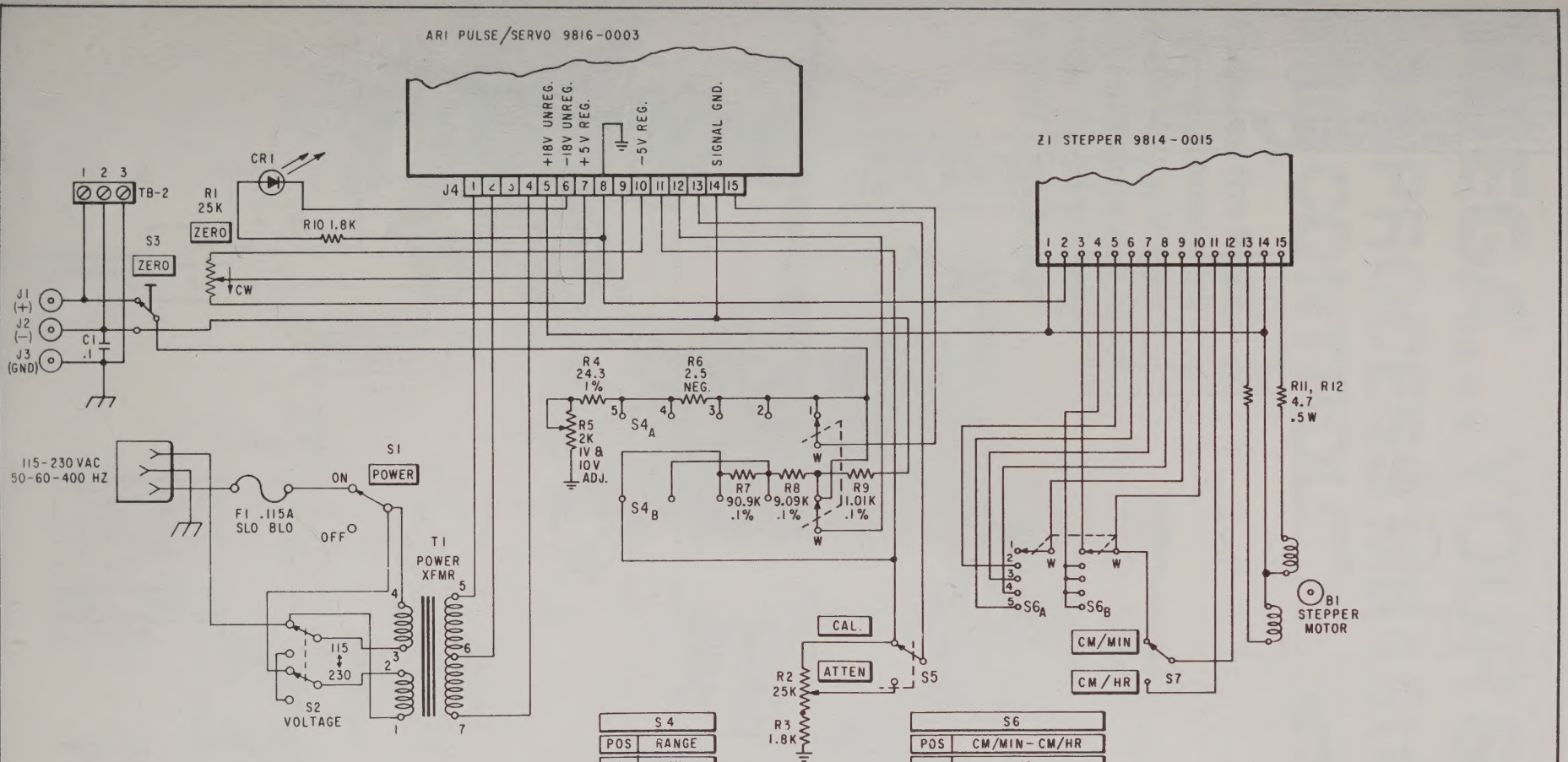
MODEL 141

PCB Assembly (Stepper Chart Drive)	9814-0015
PCB Assembly (Pulse/servo)	9501-2306
Switch, Toggle (spdt) (push to zero)	5110-0015
Transformer (Power)	5610-0012

MODEL 142

PCB Assembly (Stepper Chart Drive)	9814-0016
PCB Assembly (Pulse/servo)	9501-2307
Battery (Sealed rechargeable 12 V 2.5 AH)	3310-0001
Switch, Toggle (spdt) (push to zero and/or charge indicator)	5110-0015
Terminal Strip (rear panel)	2120-0010
Transformer (Power)	5610-0007

Important: always specify Model number, options, and serial number when ordering replacement parts and sub-assemblies.



S4	
POS	RANGE
1	1 MV
2	10 MV
3	100 MV
4	1 V
5	10 V

S6	
POS	CM/MIN - CM/HR
1	10
2	5
3	2
4	1
5	.5

VOLTAGES SHOWN ARE NOMINAL

PANEL MOUNTED CONTROLS IDENTIFIED BY BOXED NOMENCLATURE

CAPACITOR VALUES ARE IN MICROFARADS

RESISTOR VALUES ARE IN OHMS

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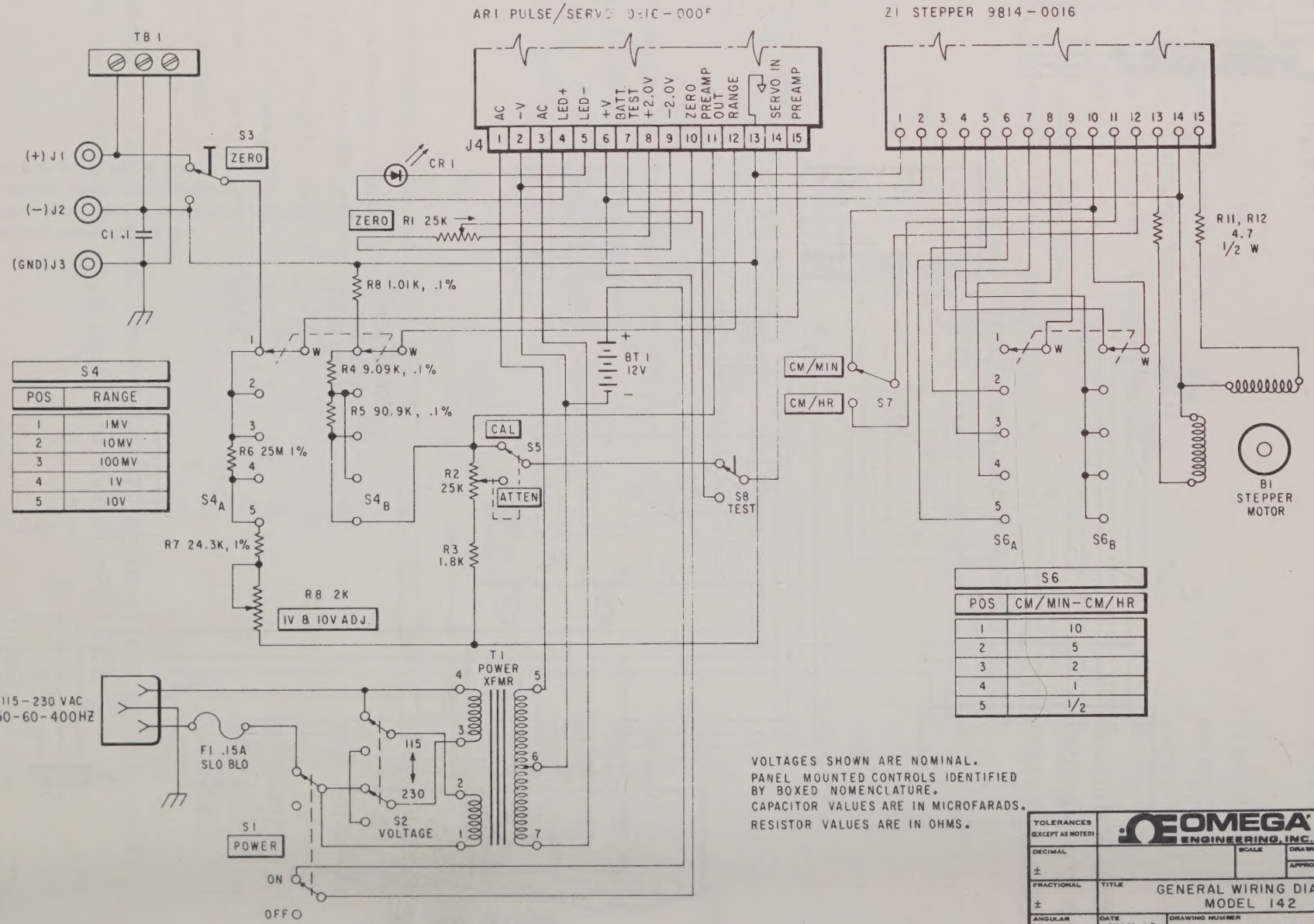
FRACTIONAL ±	TITLE GENERAL WIRING DIAGRAM MODEL 141		
ANGULAR ±	DATE JULY 11 1983	DRAWING NUMBER C050-0139	REV.



S4	
POS	RANGE
1	1MV
2	10MV
3	100MV
4	1V
5	10V

S6	
POS	CM/MIN-CM/HR
1	10
2	5
3	2
4	1
5	1/2

VOLTAGES SHOWN ARE NOMINAL.
PANEL MOUNTED CONTROLS IDENTIFIED BY BOXED NOMENCLATURE.
CAPACITOR VALUES ARE IN MICROFARADS.
RESISTOR VALUES ARE IN OHMS.

TOLERANCES (EXCEPT AS NOTED)	OMEGA ENGINEERING, INC.	Stamford Conn 06907	
DECIMAL ±	SCALE	DRAWN BY DRJ	
		APPROVED BY	
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